

Air Force Civil Engineer Center



FORMER
WILLIAMS AIR FORCE BASE

**Site LF004 Landfill
Remedial Action**

**BCT Conference Call
16 January 2020**



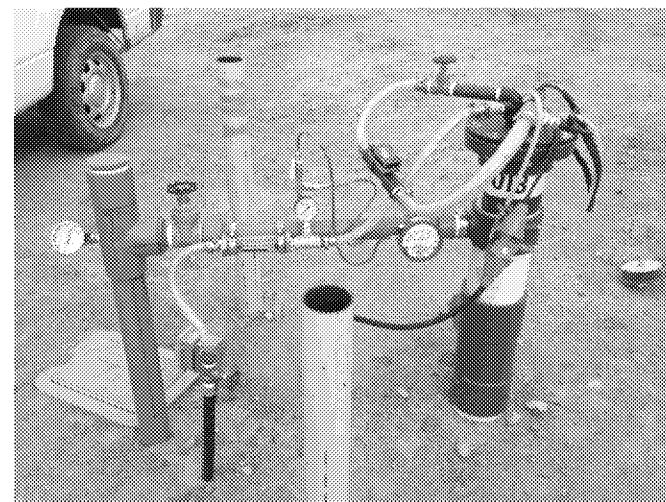
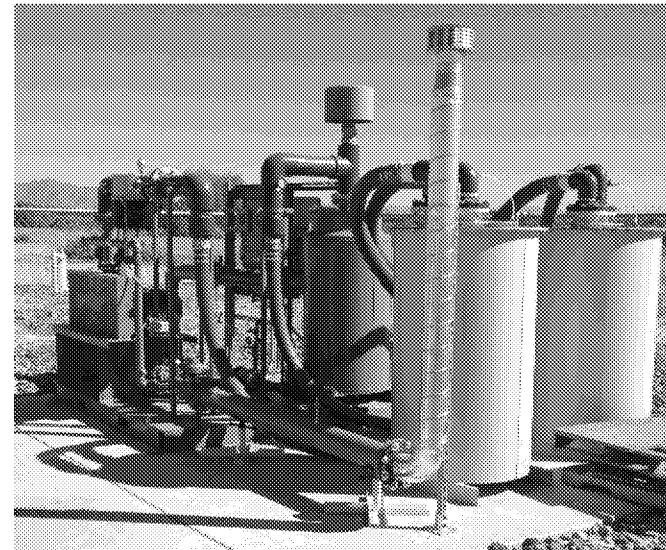
LF004 Recent and Upcoming Activities

- ADEQ comments on draft 2018 annual landfill inspection report received 17 Dec 2019. Final report in preparation.
- Minor landfill repairs completed in Dec 2019. Draft 2019 landfill inspection report in preparation.
- Planning continues for decommissioning of SVE and IWAS treatment systems
- Validation of semi-annual (Nov 2019) analytical data in progress



LF01-W17 Area IWAS System Update

- Preliminary November 2019 PDB results indicate all monitoring wells below the TCE MCL with the exception of LF01-W17S (7.9 µg/l) and LF01-W30M (10 µg/l)
- Previous May 2019 PDB for LF01-W17S (9 µg/l) and LF01-W30M (12 µg/l)
- Monitoring wells upgradient and downgradient of LF01-W17S and LF01-W30M are below TCE MCL





Southern Area SVE and Oxidant Injection

- Preliminary November 2019 PDB results indicate only three PCE MCL exceedances: W19S at 7.8 µg/l (dup 8.2 µg/l), W19D 5.6 µg/l (dup 5.4 µg/l), and W24M at 6.2 µg/l (dup 5.4 µg/l). Previous May 2019 PDB results for W19S 8.1 µg/l (dup 9.1 µg/l), and W19D <1.0 µg/l and W24M 9.7 µg/l (dup 8.6 µg/l). . .
- Upgradient wells in the vicinity of W19 and downgradient wells in the vicinity of W24 are below the PCE MCL

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**Site FT002
Fire Training Area Remedial
Action**

**BCT Conference Call
16 January 2020**



Site FT002 Update

- AF approved keeping the DEUR in place Nov 2018
- AF will prepare Explanation of Significant Differences (ESD) document to add the land use control to the ROD
- Revised Final Remedial Action Completion Report submitted 22 Nov 2019
- Received EPA comment letter on December 31, 2019. Response to comments in progress.
- If necessary, a technical conference call with regulatory agencies to resolve comments can be scheduled

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Site SS017
Old Pesticide/Paint Shop**

**BCT Conference Call
16 January 2020**



Site SS017 Groundwater Monitoring Update Path Forward

- Q3 (Aug) 2018 data summary report submitted 12 Apr 2019 is under regulatory review
- Annual (Nov) 2018 groundwater report submitted 18 Apr 2019. Reissued hard copy reports on 30 Apr 2019. Report is under regulatory review.
- Draft Q2 (Jun) 2019 data summary report submitted 30 Dec 2019
- Draft Q3 (Aug) 2019 data summary report submitted 31 Dec 2019
- Q4 (Nov) 2019 sampling and land use control inspection completed. Draft Q4 (Nov) 2019 annual report in preparation.
- Q1 quarterly sampling (MW-02) scheduled for Feb 2020



Parcel K-1-2 Property Transfer

- Draft final FOST and SEBS including RTC to ADEQ comments posted for public comment. Comment period ended 25 Mar 2019; no comments received.
- EPA comments received 11 Mar 2019
- Draft final FOST and SEBS issued to ASU for coordination
- FOST (final version in track changes responding to EPA comments) was issued via email for regulatory concurrence 24 Jul 2019 with follow up email 9 Aug 2019
- FOST clean copy with all revisions, responses to comment and ADEQ requested changes issued 15 Oct 2019
- Final FOST to be routed for AF signature after regulatory concurrence
- Draft DEUR and assignment package to be prepared
- ADEQ concurrence previously received. EPA concurrence letter received 19 Dec 2019.

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**Site ST035
Former Building 760**

**BCT Conference Call
16 January 2020**



ST035 Update

- **SVE system and enclosure decommissioning completed in July. ASU has indicated that the concrete pad, walls, and fencing will be retained for use by facilities management.**
- **Well abandonment activities complete on 22 Oct 2019. Documentation of well abandonment in preparation.**

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**FORMER
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Site ST012
Former Liquid Fuel
Storage Area**

**BCT Conference Call
16 January 2020**



Site ST012 Outline

- Summary of activities since Dec BCT call
- Update on SVE system (JP-4 equivalent of methane)
- LNAPL removal update
- Updated on benzene and sulfate concentrations
- Evaluation of potential biological testing locations
- Pilot study extraction/injection update
- Path forward



Site ST012 Activities Since Dec

- **SVE operation through 27 Dec 2019**
 - Variable frequency drive for the SVE blower failed on 27 Dec 2019.
 - Troubleshooting during the week of 30 Dec
 - New VFD ordered week of 6 Jan
 - Rebound monitoring ongoing
 - PID/FID readings on all wells every two weeks
 - Sample select wells prior to restart
- **LNAPL screening in select wells**
- **Sodium sulfate injections (detail on later slides)**





Site ST012 Activities Since Dec

- **Operation of Extraction and Treatment**

- **Pump Maintenance**

- Pump installed in W36; UWBZ25 and LSZ43 pumps replaced.
 - Tried a submersible pump in UWBZ21, but experienced over temp shut down.
 - LSZ37 redeveloped, pump reinstallation pending
 - Pneumatic extraction pumps continue to need cleaning and reinstallation
 - Pumps currently running
 - CZ07, CZ23, UWBZ21, UWBZ25, LSZ11, LSZ43
 - W36 (pump installed and ready to pump)
 - LSZ28 (only pumped occasionally to supply warm water for sulfate mixing),
 - Pumps currently down
 - CZ21 (electrical), UWBZ22 (plugging), UWBZ30 (plugging), LSZ12 (electrical)
 - LSZ37 previously shut down for sulfate concentration but may want to restart. Pump was pulled from well.

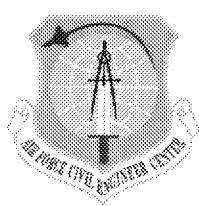
- **Treatment System Maintenance**

- Replaced transducer in equalization tank (down from 27 Dec 2019 to 2 Jan 2020)

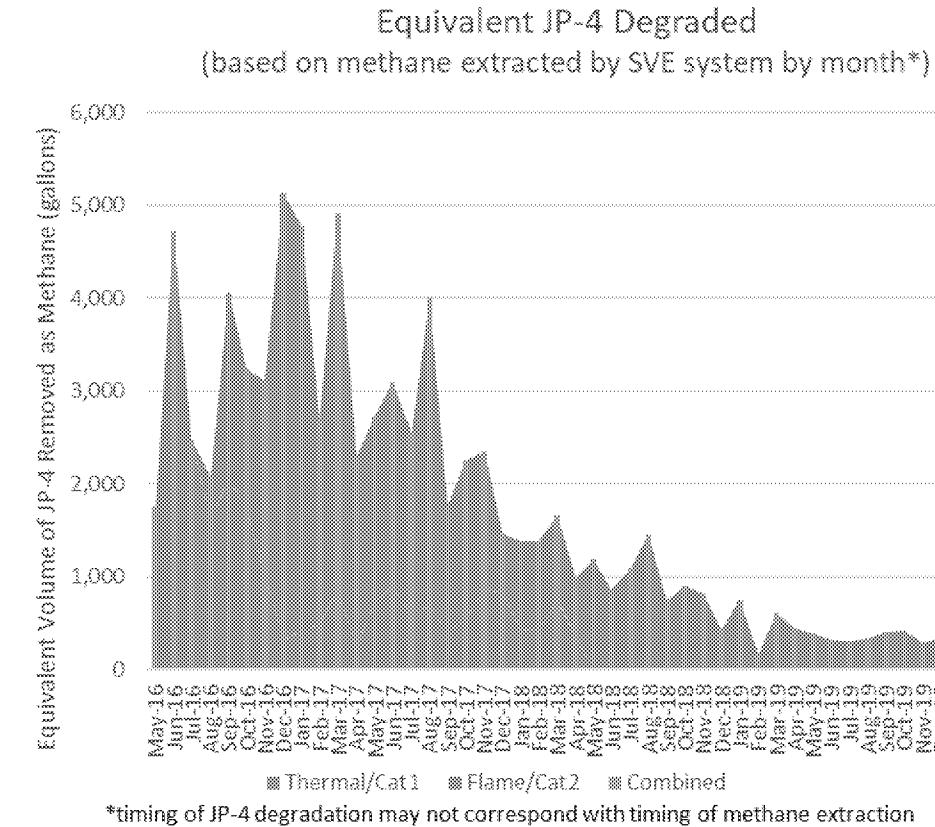
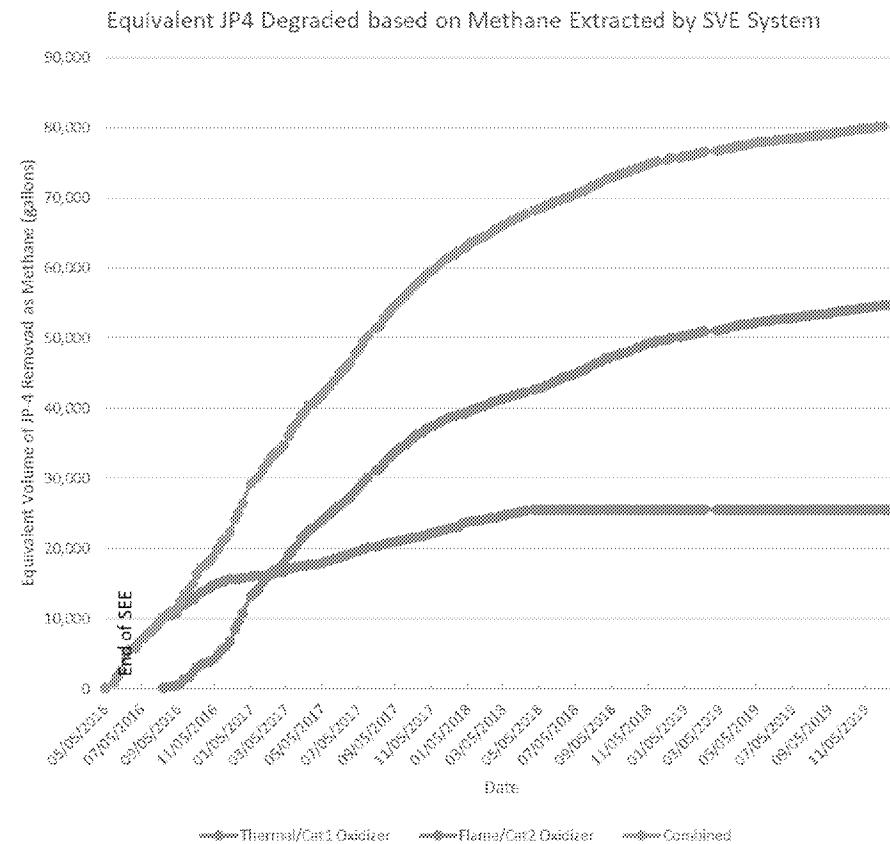




JP-4 Degradation Based on Methane Removed with SVE



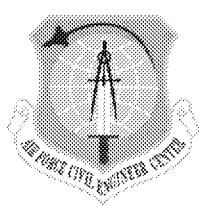
Site ST012 SVE System Equivalent JP-4 Degradation Based on Methane Removed



- Estimates through 27 Dec 2019
- Estimated JP-4 degradation as methane is in addition to JP-4 removal reported for SVE
- Thermal/Cat1 oxidizer changed from SVE to groundwater treatment end of Apr 2018 (low methane concentrations recently observed but attributed to vapor bleed through closed valve from SVE)
- Flame oxidizer treating combined SVE and air stripper intermittently in Nov 2018 – Jan 2019
- Flame oxidizer replaced by catalytic oxidizer (Cat2) 7 Feb to 26 Feb 2019

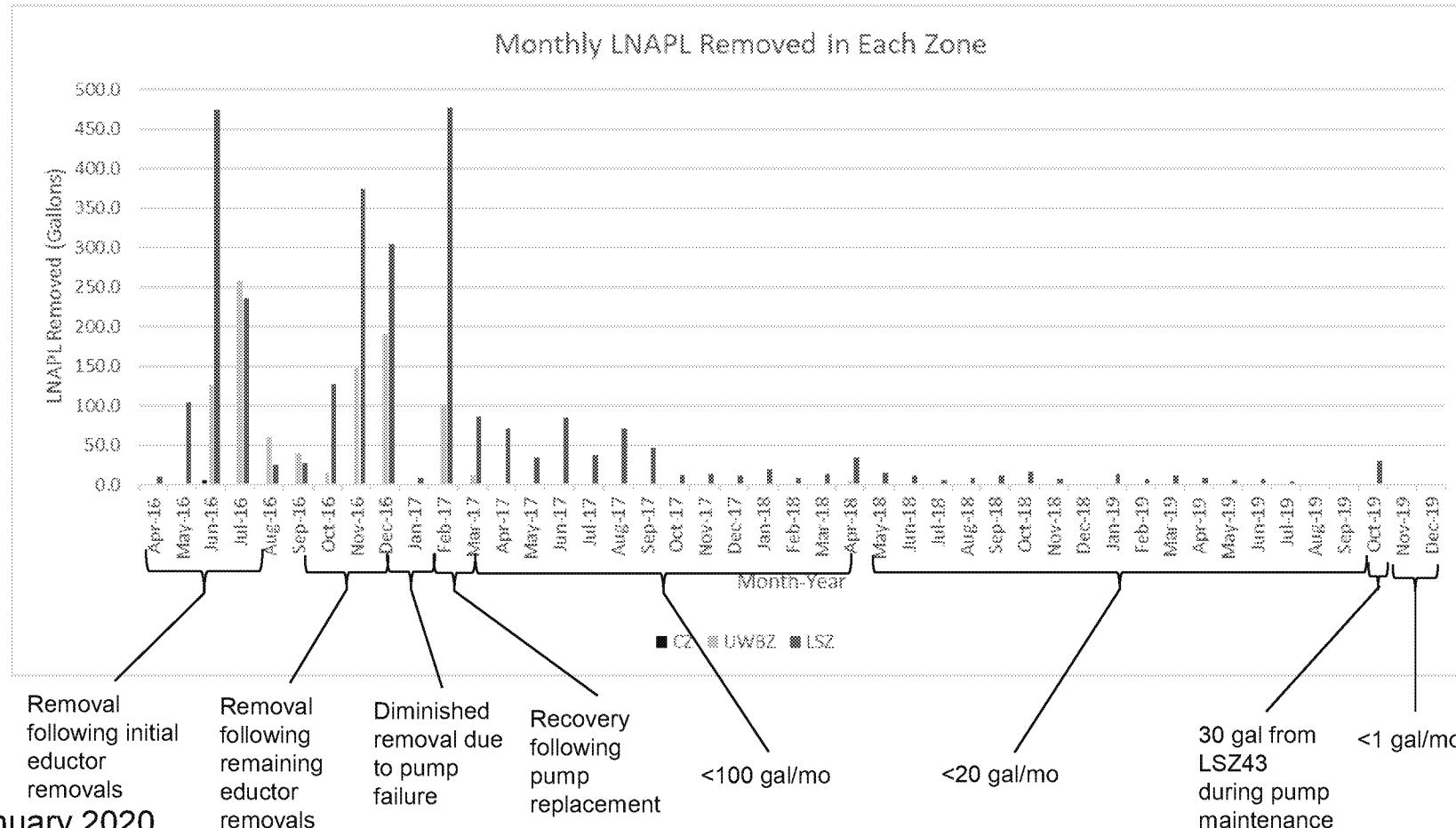


LNAPL Removal Update (through 05 Jan)



ST012 LNAPL Removal Summary

- CZ – 7.5 gallons of LNAPL removed. 0.5 gallons removed since Nov 2016 (CZ18)
- UWBZ – 963 gallons of LNAPL removed. None since Apr update.
- LSZ – 2,874 gallons of LNAPL removed. 0.5 Gallons removed since Dec update. (W37)





Preliminary Fourth Quarter Groundwater Sampling Results



Sampling Summary

- **Sampling includes:**

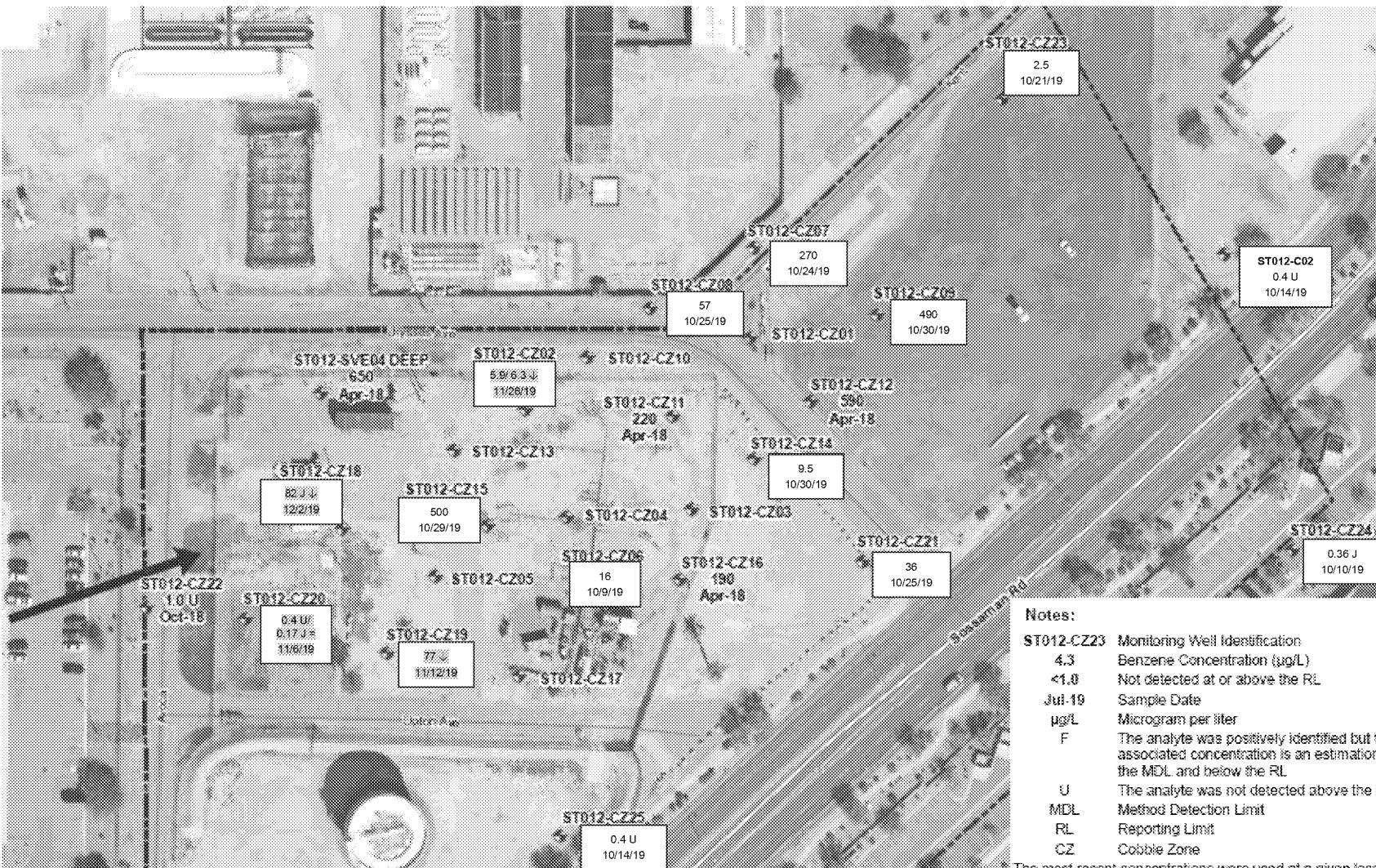
- Extraction Wells
- Injection Wells (where injections took place)
- Monitoring Wells (in areas where injections took place)
- Perimeter Wells

- **General Observations**

- Benzene at perimeter well LSZ54 not detected in 26 Dec 2019 sample
- Benzene at perimeter well U02 decreased to < 1 µg/L in 26 Dec 2019 sample



Site ST012 Benzene (µg/L) in CZ



Notes:

- ST012-CZ23 Monitoring Well Identification
- 4.3 Benzene Concentration (µg/L)
- <1.0 Not detected at or above the RL
- Jul-19 Sample Date
- µg/L Microgram per liter
- F The analyte was positively identified but the associated concentration is an estimation above the MDL and below the RL
- U The analyte was not detected above the RL
- MDL Method Detection Limit
- RL Reporting Limit
- CZ Cobble Zone

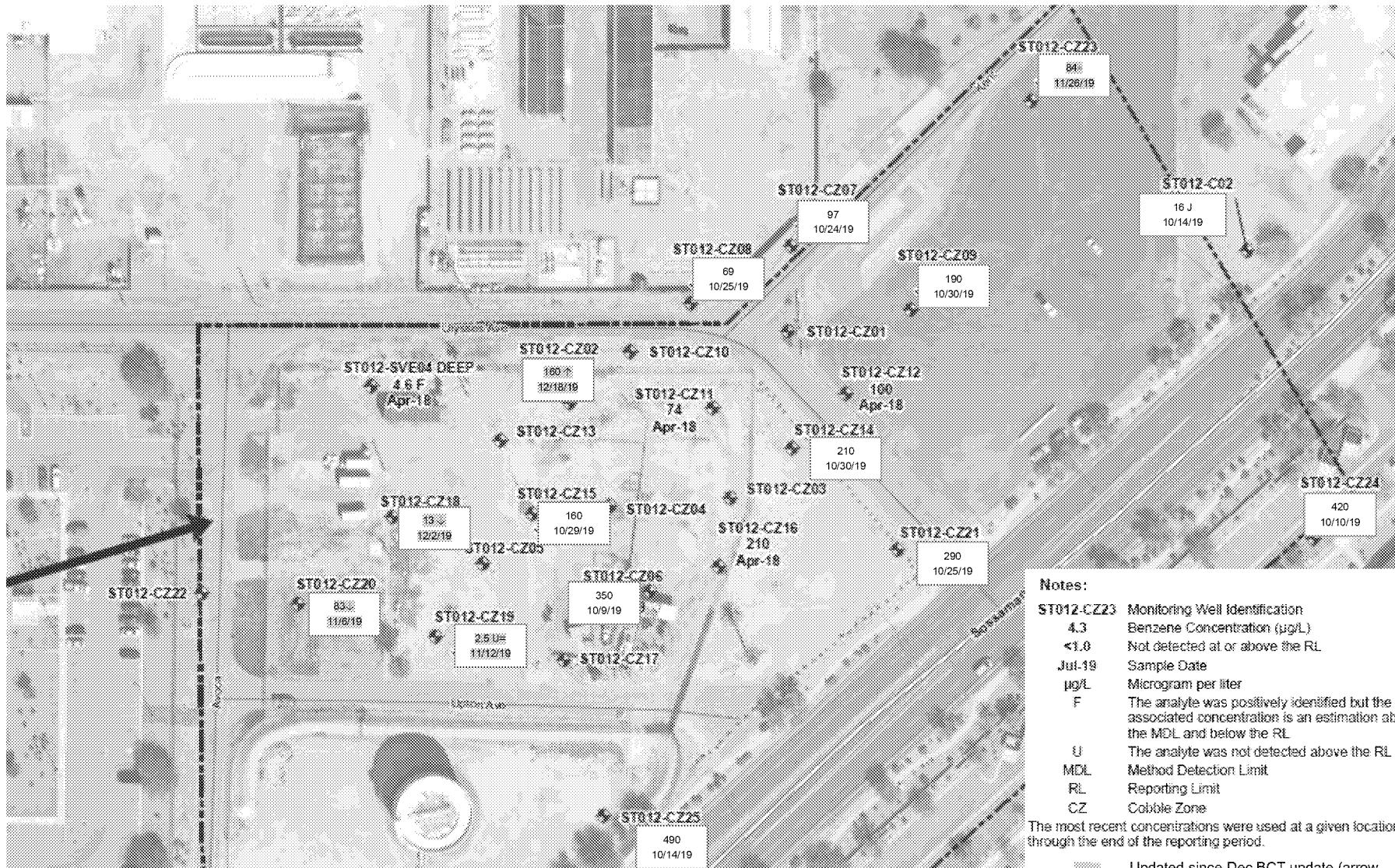
The most recent concentrations were used at a given location through the end of the reporting period.



Updated since Dec BCT update (arrow indicates direction of change from previous result)



Site ST012 Sulfate (mg/L) in CZ

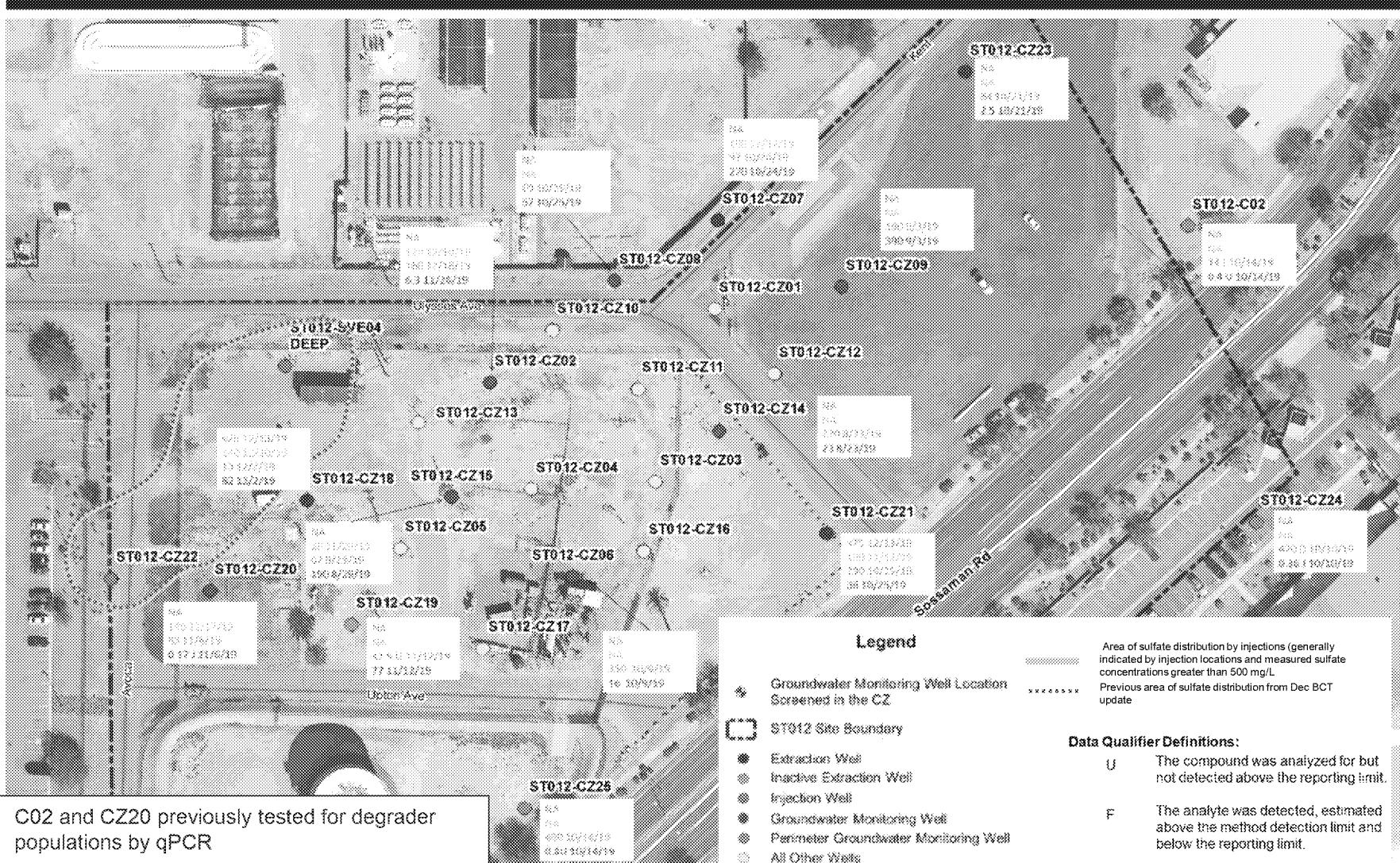


Updated since Dec BCT update (arrow indicates direction of change from previous result)

ED_005025_00009570-00023



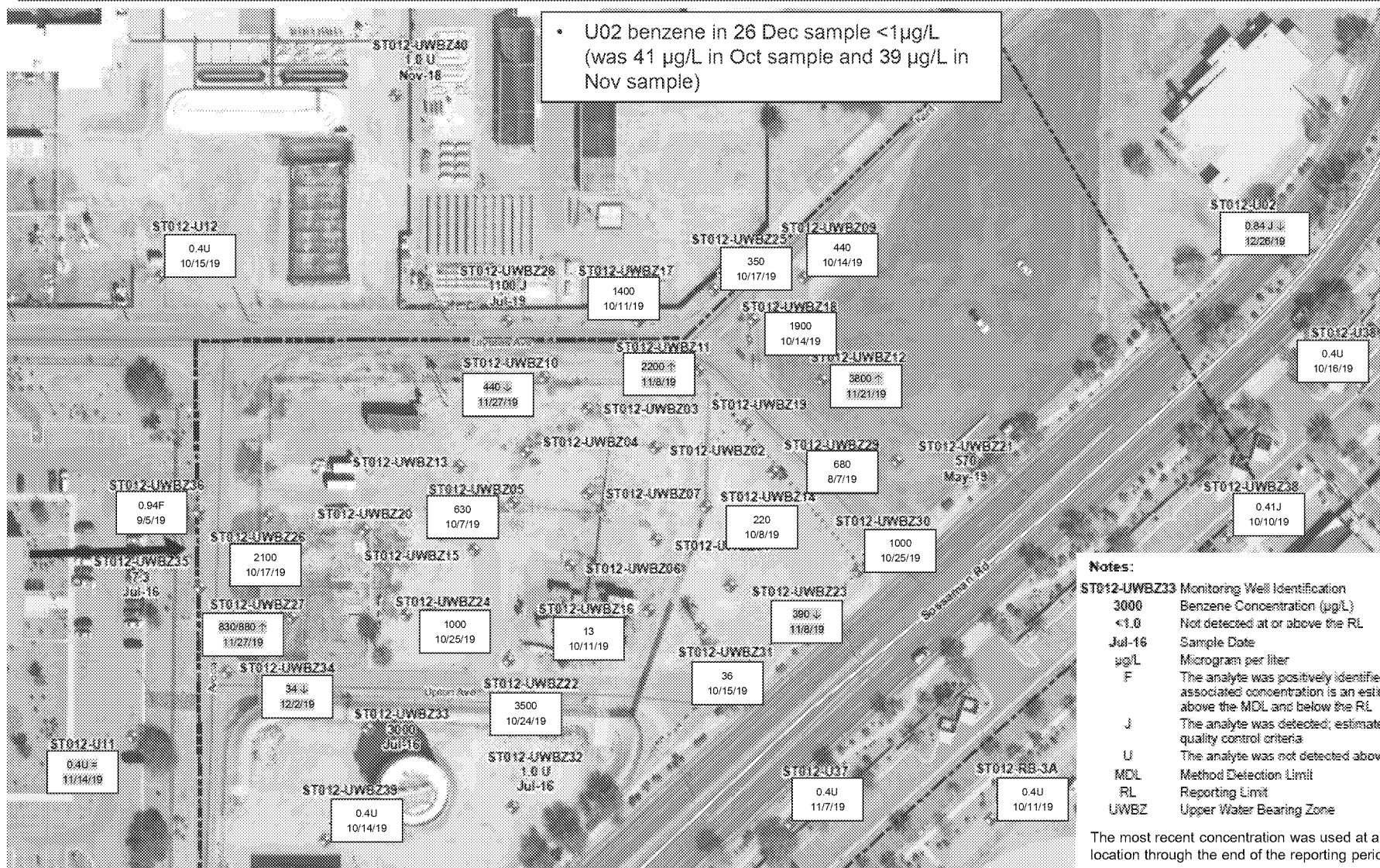
EBR Treatment Area in CZ



- CO₂ and CZ20 previously tested for degrader populations by qPCR
- Planning to inject 6 tons in CZ10 for subphase 4



Site ST012 Benzene ($\mu\text{g}/\text{L}$) in UWBZ

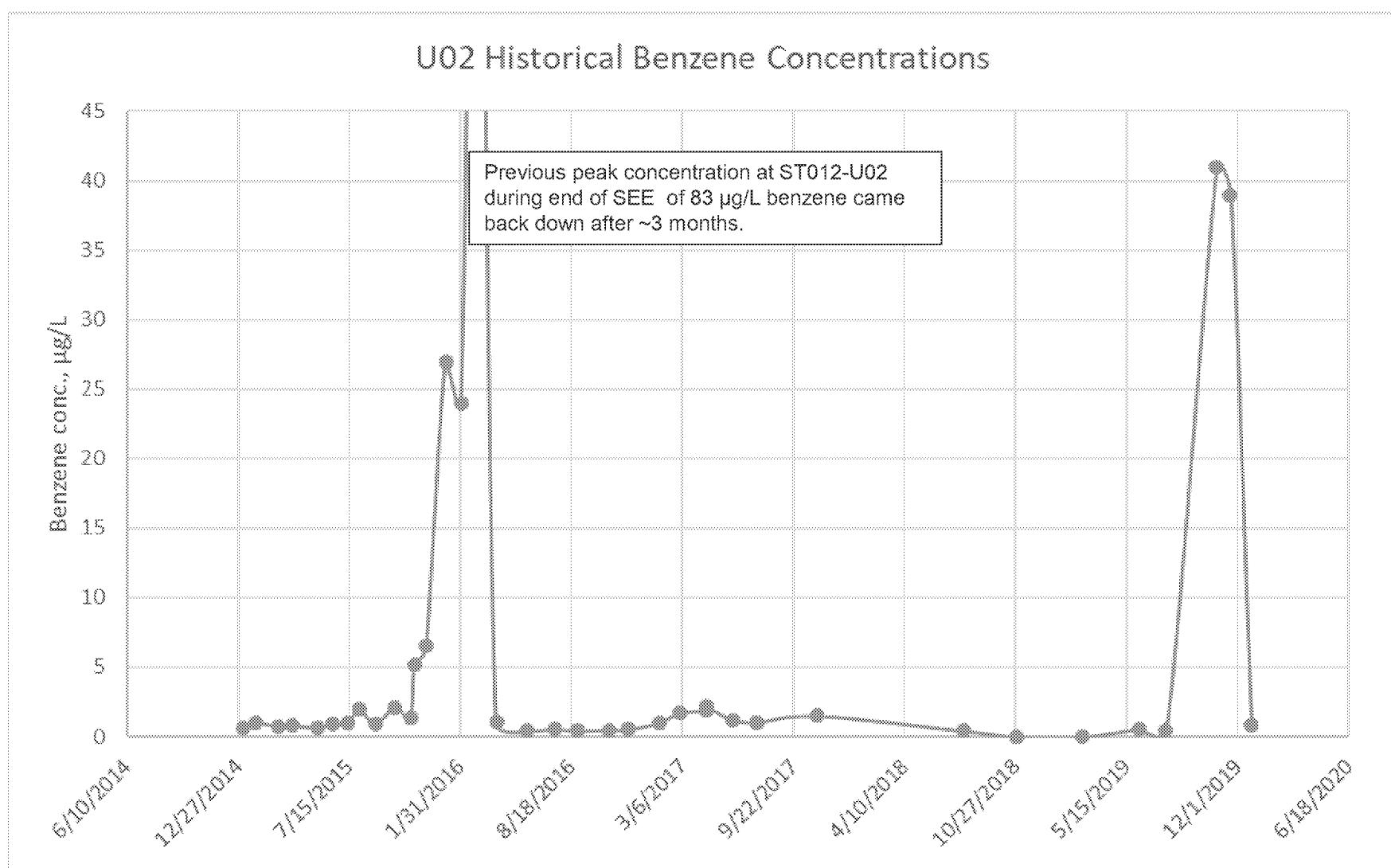


Updated since Dec BCT update (arrow indicates direction of change from previous result)

ED_005025_00009570-00025

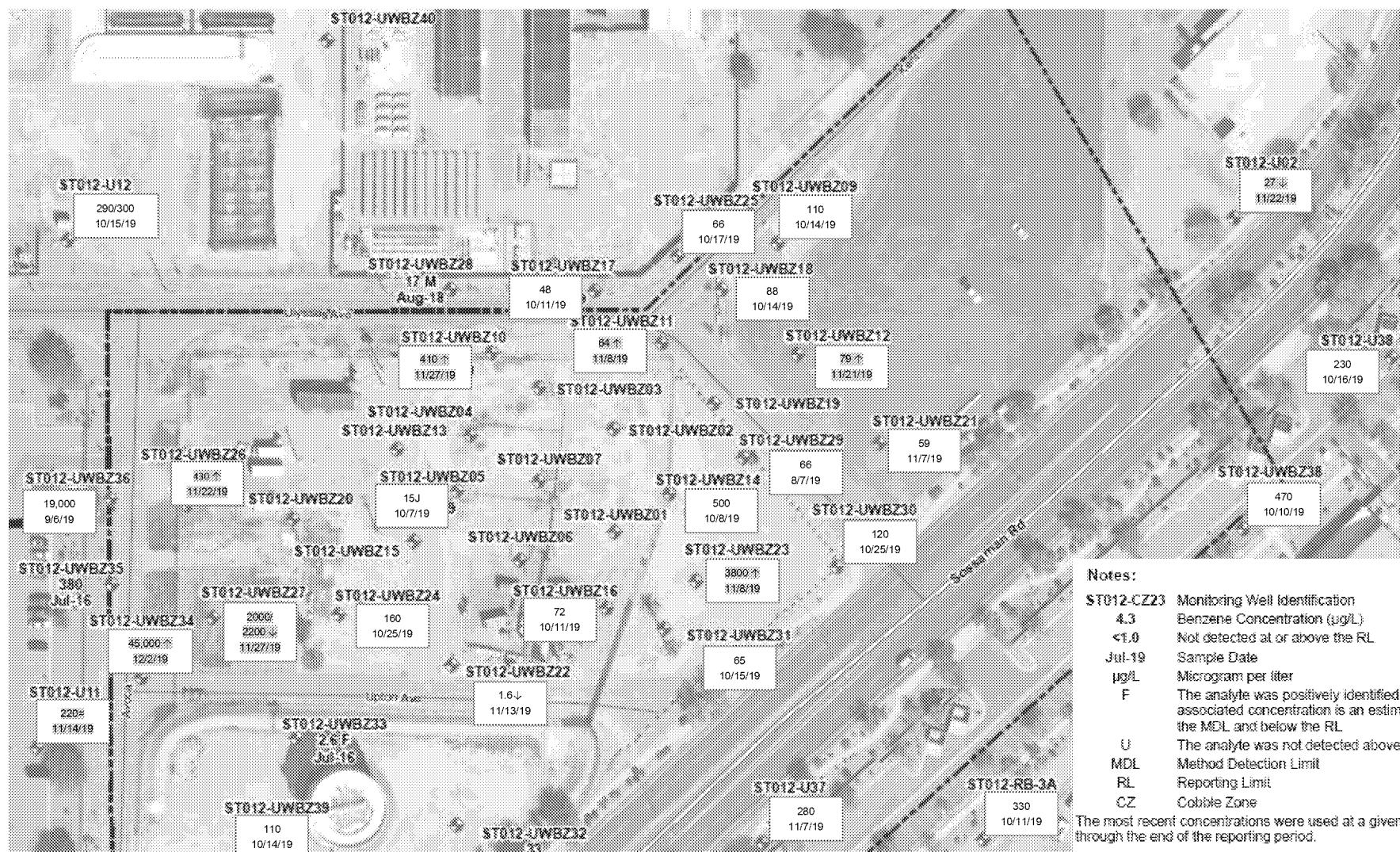


Site ST012 U02 Historical Benzene Concentration





Site ST012 Sulfate (mg/L) in UWBZ



Updated since Dec BCT update (arrow indicates direction of change from previous result)



EBR Treatment Areas in UWBZ

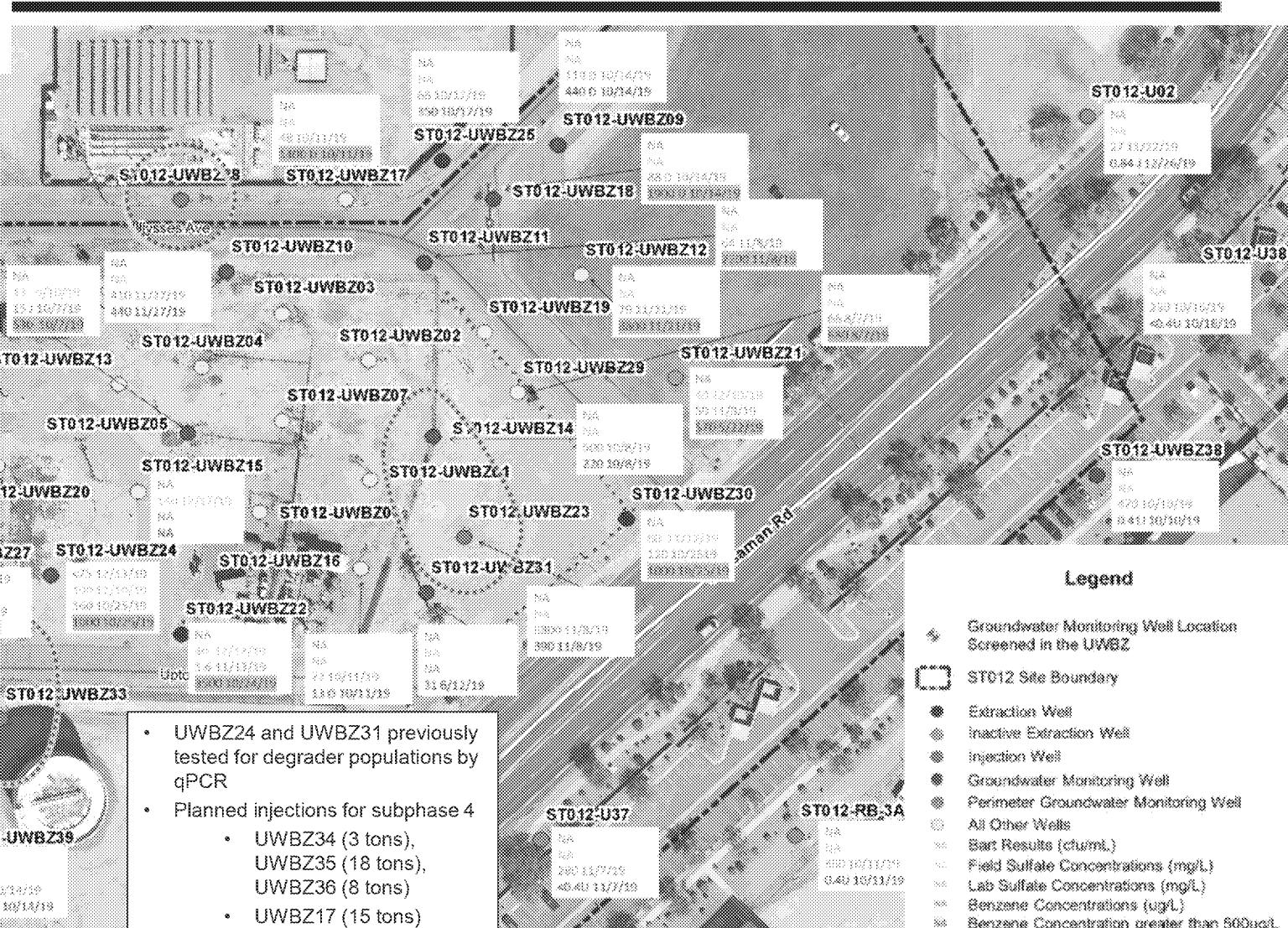
Area of sulfate distribution by injections (generally indicated by injection locations and measured sulfate concentrations greater than 500 mg/L)
Previous area of sulfate distribution from Dec BCT update

Data Qualifier Definitions:

✓ The compound was analyzed for but not detected above the reporting limit.

✗ The sulfate was detected, estimated above the method detection limit and below the reporting limit.

Notes:
ST012-UWBZ14 Monitoring Well Identifier
UWBZ Upper Water Bearing Zone

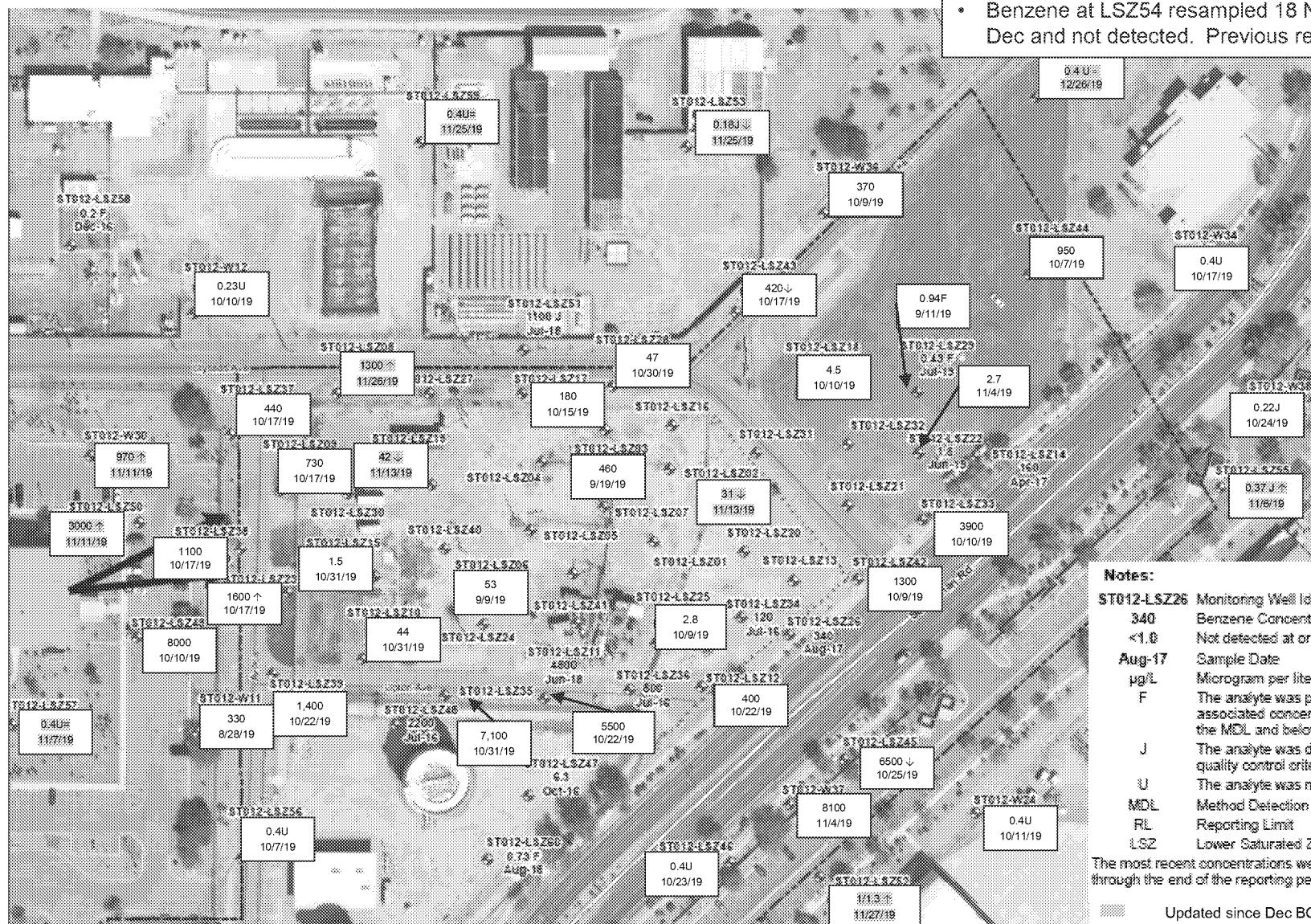


- UWBZ24 and UWBZ31 previously tested for degrader populations by qPCR
- Planned injections for subphase 4
 - UWBZ34 (3 tons), UWBZ35 (18 tons), UWBZ36 (8 tons)
 - UWBZ17 (15 tons)
 - UWBZ23 (3 tons) – after improving pumping



Site ST012 Benzene (mg/L) in LSZ

- Benzene previously detected at 55 µg/L in Oct sample at LSZ54
- Benzene at LSZ54 resampled 18 Nov and 26 Dec and not detected. Previous result suspect.



Notes:

ST012-LSZ26 Monitoring Well Identification

340 Benzene Concentration (µg/L)

<1.0 Not detected at or above the RL

Aug-17 Sample Date

µg/L Microgram per liter

F The analyte was positively identified but the associated concentration is an estimation above the MDL and below the RL.

J The analyte was detected, estimated due to quality control criteria.

U The analyte was not detected above the RL.

MDL Method Detection Limit

RL Reporting Limit

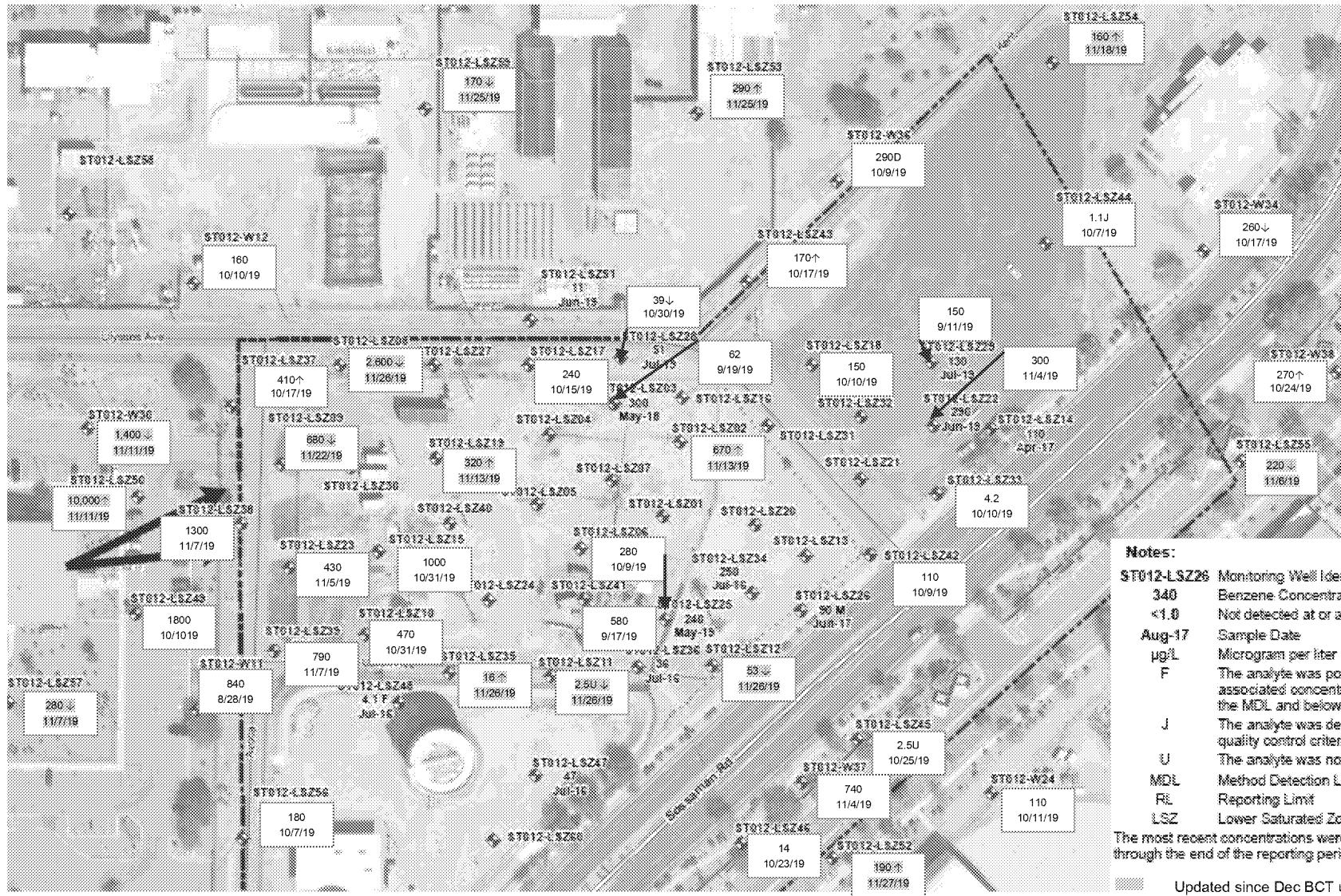
LSZ Lower Saturated Zone

The most recent concentrations were used at a given location through the end of the reporting period.

Updated since Dec BCT update (arrow indicates direction of change from previous result)



Site ST012 Sulfate (mg/L) in LSZ



Notes:

ST012-LSZ26	Monitoring Well Identification
340	Benzene Concentration ($\mu\text{g/L}$)
<1.0	Not detected at or above the RL
Aug-17	Sample Date
$\mu\text{g/L}$	Microgram per liter
F	The analyte was positively identified but the associated concentration is an estimation above the MDL and below the RL
J	The analyte was detected; estimated due to quality control criteria
U	The analyte was not detected above the RL
MDL	Method Detection Limit
RL	Reporting Limit
LSZ	Lower Saturated Zone

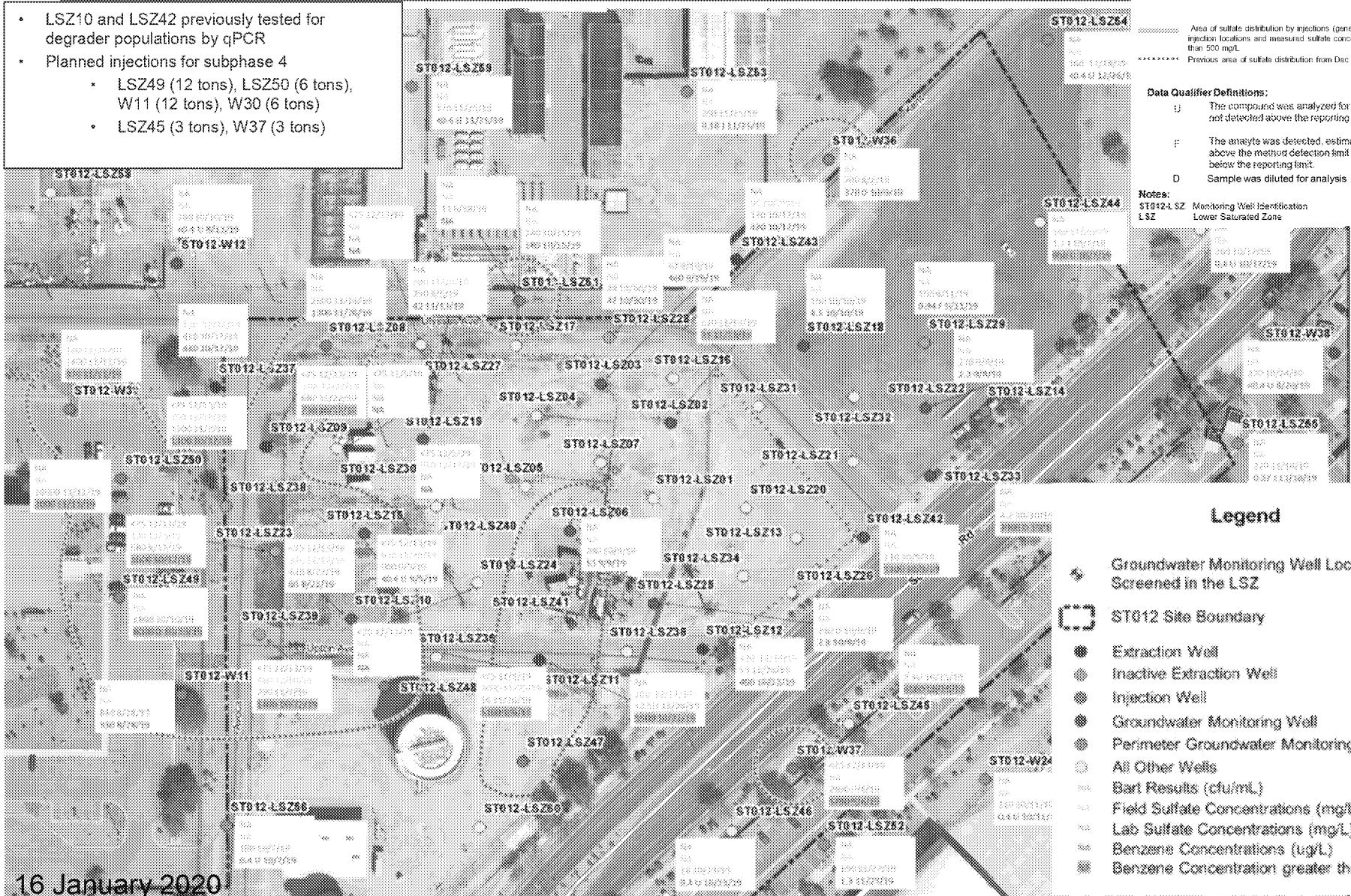
The most recent concentrations were used at a given location through the end of the reporting period.

Updated since Dec BCT update (arrow indicates direction of change from previous result)



EBR Treatment Areas in LSZ

- LSZ10 and LSZ42 previously tested for degrader populations by qPCR
- Planned injections for subphase 4
 - LSZ49 (12 tons), LSZ50 (6 tons), W11 (12 tons), W30 (6 tons)
 - LSZ45 (3 tons), W37 (3 tons)





Site ST012 Potential Biological Testing Locations

- Evaluation presented in Nov BCT call for well locations for potential biological testing
- BART retest samples collected on 13 Dec 2019
 - CZ18
 - UWBZ24
 - UWBZ26
 - UWBZ27
 - LSZ09
 - LSZ10
 - LSZ15
 - LSZ24
 - LSZ27
 - LSZ38
 - LSZ39
 - W37
- Testing completed – UWBZ27 reacted in five days (~27,000 cfu/ml), other wells did not react
- BioTraps® deployment discussion to follow



Site ST012 Potential Biological Testing Location UWBZ26

- **Former extraction well**
 - **Indicators of a good location**
 - Sulfate distribution above background -yes
 - Field parameters (neutral pH, low dissolved oxygen, negative ORP)-yes
 - Positive BART test kit result-yes in September, no in December
 - Possible benzene reduction-yes
 - Possible sulfate consumption-yes



Site ST012 Potential Biological Testing Location UWBZ27

Extraction Well Status	Sample Date	Days to Reaction	Approximate SRB Population (cfu/mL)	UWBZ27															
				TPH-DRO mg/L	TPH-GRO mg/L	Benzene ug/L	EthyBenzene ug/L	Naphthalene ug/L	Toluene ug/L	Xylenes Total ug/L	Nitrogen, nitrate mg/L	Nitrogen, nitrite mg/L	Sulfate mg/L	Sulfate (Field) mg/L	Temperature (Field) °F	pH (Field)	Conductivity (Field) µS/cm	DO (Field) mg/L	ORP (Field) mV
Offline	8/13/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1000	NA	NA	NA	NA	NA
Offline	8/27/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	900	NA	NA	NA	NA	NA
Offline	8/29/2019	NA	NA	1.8	1.8	640	57	15	15	110	0.20	J	NA	NA	NA	NA	NA	NA	NA
Offline	8/29/2019	NA	NA	1.5	0.24	570	55	11	20	8.8	J	0.20	J	NA	NA	NA	NA	NA	NA
Offline	9/10/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	580	NA	NA	NA	NA	NA
Offline	9/24/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	540	NA	NA	NA	NA	NA
Offline	10/8/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	600	NA	NA	NA	NA	NA
Offline	11/20/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	480	NA	NA	NA	NA	NA
Offline	11/27/2019	NA	NA	1.3	3.7	880	120	44	140	150	0.2	U	NA	2200	NA	NA	NA	NA	NA
Offline	12/3/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	350	NA	NA	NA	NA	NA
Offline	12/13/2019	4	27,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	83.66	6.67	5670	3.14	106.2
Offline	12/17/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	300	NA	NA	NA	NA	NA

- **Former extraction well**
- **Indicators of a good location**
 - Sulfate distribution above background –yes previously, approaching background recently
 - Field parameters (neutral pH, low dissolved oxygen, negative ORP)-yes
 - Positive BART test kit result-yes in December
 - Possible benzene reduction-no
 - Possible sulfate consumption-yes



Site ST012 Potential Biological Testing Location LSZ38

Extraction Well Status	Sample Date	Days to Reaction	Approximate SRB Population (cfu/ml)	LSZ38															
				TPH-DRO mg/l	TPH-GRO ug/l	Benzene ug/l	Ethylbenzene ug/l	Naphthalene ug/l	Toluene ug/l	Xylenes, Total ug/l	Nitrogen, nitrate mg/l	Nitrogen, nitrite mg/l	Sulfate mg/l	Sulfate (Field) mg/l	Temperature (Field) °F	pH (Field)	Conductivity (Field) µS/cm	DO (Field) mg/L	ORP (Field) mV
Pumping	2/12/2019	NA	NA	NA	2100	75	< 100	U	800	890	NA	NA	NA	NA	NA	NA	NA	NA	
Pumping	4/23/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	20	NA	NA	NA	NA	NA	
Pumping	5/13/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12	NA	NA	NA	NA	NA	
Pumping	5/29/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	130	NA	NA	NA	NA	NA	
Pumping	6/11/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	150	NA	NA	NA	NA	NA	
Pumping	6/14/2019	NA	NA	1.2	6.8	2200	180	41	520	780	3.1	NA	98	NA	NA	NA	NA	NA	
Pumping	6/20/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.0	J	NA	100	NA	NA	NA	NA	
Pumping	6/25/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	90	NA	NA	NA	NA	NA	
Pumping	6/26/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.4	< 1.0	U	160	NA	NA	NA	NA	
Pumping	7/16/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	430	NA	NA	NA	NA	NA	
Pumping	7/18/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	350	NA	NA	NA	NA	NA	
Pumping	7/30/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	530	NA	NA	NA	NA	NA	
Pumping	8/13/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	560	NA	NA	NA	NA	NA	
Shutoff 08/26/2019	8/27/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	750	NA	NA	NA	NA	NA	
Offline	8/28/2019	NA	NA	.81	3.6	1800	220	26	120	370	.65	NA	1000	NA	NA	NA	NA	NA	
Offline	9/3/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1000	NA	NA	NA	NA	NA	
Offline	9/6/2019	2	500,000	NA	NA	690	140	28	57	110	NA	NA	1100	NA	NA	NA	NA	NA	
Offline	9/10/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	980	NA	NA	NA	NA	NA	
Offline	9/17/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1200	870	NA	NA	NA	NA	
Offline	9/24/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	750	NA	NA	NA	NA	NA	
Offline	10/8/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1500	NA	NA	NA	NA	NA	
Offline	10/17/2019	NA	NA	0.9	2.7	1100	190	42	37	110	1.0	U	NA	730	7000	80.54	7.38	5188	9.03
Offline	11/1/2019	8	75	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	80.64	7.51	5580	2	247.3	
Offline	11/7/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1300	NA	NA	NA	NA	NA	
Offline	11/20/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2000	NA	NA	NA	NA	NA	
Offline	12/3/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	460	NA	NA	NA	NA	NA	
Offline	12/3/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1060	NA	NA	NA	NA	NA	
Offline	12/10/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	800	NA	NA	NA	NA	NA	
Offline	12/13/2019	9	<75	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	85.28	6.52	5300	1.68	-44.5	

- Former extraction well
- Indicators of a good location
 - Sulfate distribution above background -yes
 - Field parameters (neutral pH, low dissolved oxygen, negative ORP)-yes, but changing
 - Positive BART test kit result-yes in September, no in December
 - Possible benzene reduction-yes
 - Possible sulfate consumption-no in lab data (yes in field data)



Site ST012 Potential Biological Testing Location LSZ39

Extraction Well Status	Sample Date	Days to Reaction	Approximate SRB Population [cfu/ml]	LSZ39															
				TPH-DRO mg/l	TPH-GRO mg/l	Benzene ug/l	Ethylbenzene ug/l	Naphthalene ug/l	Toluene ug/l	Xylenes, Total ug/l	Nitrogen, nitrate mg/l	Nitrogen, nitrite mg/l	Sulfate mg/l	Sulfate (Field) mg/l	Temperature (Field) °F	pH (Field)	Conductivity (Field) µS/cm	DO (Field) mg/l	ORP (Field) mV
Pumping	2/12/2019	NA	NA	NA	NA	130	J	7.5	F	6.4	I	66	J	110	J	NA	NA	NA	NA
Pumping	3/29/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	850	NA	NA	NA	NA	
Pumping	4/16/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	210	NA	NA	NA	NA	
Pumping	4/26/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1230	NA	NA	NA	NA	
Pumping	4/29/2019	6	1,400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Shutoff 05/01/2019	5/15/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1700	1425	NA	NA	NA	
Offline	5/29/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1430	NA	NA	NA	NA	
Offline	6/11/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1410	NA	NA	NA	NA	
Offline	6/17/2019	NA	NA	1.9	12	4200	530	82	1700	1600	< 1.0	U	NA	720	NA	NA	NA	NA	
Offline	6/17/2019	NA	NA	2.5	15	4500	580	83	1800	1800	< 1.0	U	NA	720	NA	NA	NA	NA	
Offline	6/17/2019	4	27,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Offline	7/9/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1220	NA	NA	NA	NA	
Offline	8/6/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1200	NA	NA	NA	NA	
Offline	8/28/2019	NA	NA	1.5	J	7.7	3100	630	83	560	1500	0.14	NA	420	NA	NA	NA	NA	
Offline	10/22/2019	NA	NA	9	J	11	1400	J	300	68	260	760	0.2	U	NA	350	NA	95.46	
Offline	11/1/2019	10	<75	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	85.09	7.2	7527	0.7	
Offline	11/7/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Offline	11/20/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	900	NA	NA	NA	NA	
Offline	12/10/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	460	NA	NA	NA	NA	
Offline	12/13/2019	7	<75	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	77.36	6.64	6620	4.8	
																		-97.6	

- Former extraction well
- Indicators of a good location
 - Sulfate distribution above background -yes
 - Field parameters (neutral pH, low dissolved oxygen, negative ORP)-yes in October, reducing conditions not as strong recently
 - Positive BART test kit result-yes in June, no in December
 - Possible benzene reduction-yes
 - Possible sulfate consumption-yes



Site ST012 Potential Biological Testing Location W37

Extraction Well Status		W37																		
Sample Date	Days to Reaction	Approximate SRB Population (cfu/mL)	TPH-DRO mg/L	TPH-GRO mg/L	Benzene ug/L	Ethylbenzene ug/L	Naphthalene ug/L	Toluene ug/L	Xylenes, Total ug/L	Nitrogen, nitrate mg/L	Nitrogen, nitrite mg/L	Sulfate (Lab) mg/L	Sulfate (Field) mg/L	Temperature (Field) °F	pH (Field)	Conductivity (Field) µS/cm	DO (Field) mg/L	ORP (Field) mV		
Not applicable	1/9/2015	NA	0.84	16	2700	920	57	950	1900	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Not applicable	1/30/2015	NA	NA	1400	46	4400	2400	130	5300	5600	NA	NA	NA	NA	NA	NA	NA	NA		
Not applicable	3/12/2015	NA	NA	6300	310	9700	3500	420	7600	7700	NA	NA	NA	NA	NA	NA	NA	NA		
Not applicable	4/9/2015	NA	NA	NA	170	18000	24000	12000	36000	160000	NA	NA	NA	NA	NA	NA	NA	NA		
Not applicable	6/30/2016	NA	NA	1.8	36	11000	760	62	7100	2200	0.5	U	NA	1.4	F	NA	NA	NA		
Not applicable	7/27/2016	NA	NA	1.1	33	13000	950	43	F	8200	2300	NA	NA	NA	NA	NA	NA	NA		
Not applicable	9/13/2016	NA	NA	1.3	32	I	10000	780	50	5100	2000	NA	NA	NA	NA	NA	NA	NA		
Not applicable	11/2/2016	NA	NA	1.3	46	12000	1100	100	U	5800	2400	NA	NA	NA	86.4	6.53	4094	1.94	83.5	
Not applicable	12/6/2016	NA	NA	1.1	46	12000	980	71	F	5900	2200	NA	NA	NA	NA	NA	NA	NA	NA	
Not applicable	2/6/2017	NA	NA	1.4	52	11000	960	59	5400	2200	NA	NA	NA	NA	78.68	6.85	4412	4.97	45.6	
Not applicable	3/8/2017	NA	NA	4.4	53	12000	1200	74	F	5900	2900	0.5	U	NA	5	U	NA	80.5	6.32	
Not applicable	7/21/2017	NA	NA	0.77	29	11000	460	100	U	4100	1000	NA	NA	NA	83.01	6.82	2116	0.5	55	
Not applicable	11/10/2017	NA	NA	1.3	32	12000	970	50	U	5000	2200	NA	NA	NA	82.46	6.85	3901	5.14	-21.8	
Not applicable	11/16/2018	NA	NA	24	47	10000	1400	190	F	9400	3700	NA	NA	NA	NA	NA	NA	NA	NA	
Not applicable	3/22/2019	NA	NA	24	47	2300	1400	190	F	9400	3700	NA	NA	190	NA	NA	NA	NA	NA	
Not applicable	7/1/2019	NA	NA	0.54	8.5	3800	100	40	U	1700	260	2.5	U	NA	5600	NA	NA	NA	NA	
Not applicable	9/4/2019	NA	NA	NA	NA	5700	670	100	U	2200	850	0.5	U	NA	2600	NA	NA	NA	NA	
Not applicable	11/4/2019	5	6000	0.73	19	8100	680	160	U	1500	570	0.16	JV	NA	740	NA	77.59	6.86	4076	
Not applicable	12/13/2019	8	<75	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	74.12	6.54	4700	2.39	51.6

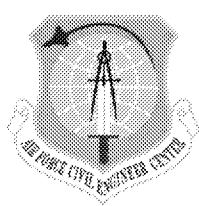
- Current injection well

- Indicators of a good location

- Sulfate distribution above background -yes
- Field parameters (neutral pH, low dissolved oxygen, negative ORP)-yes in November, no recently
- Positive BART test kit result-yes in November, no in December
- Possible benzene reduction-yes
- Possible sulfate consumption-yes



Pilot Study Injection/Extraction Update



Site ST012 Extraction System Performance

Extraction System Status Summary

Extraction Well	Calculated Average Extraction Rate in Period gpm	Maximum Temperature Since May 2018 °F	Most Recent Temperature °F	Cumulative Extraction Since May 2018 gallons	Note
ST012-CZ07	7.1	175	143	4,536,860	
ST012-CZ18	Off	136	126	3,019,867	Extraction stopped due to sulfate presence (Oct 2019)
ST012-CZ19	NA				Eliminated as an extraction well by FVM#7
ST012-CZ21	0.0	150	110	452,498	Totalizer reading suspect. Pump currently down.
ST012-CZ23	3.0	105	104	536,766	
CZ Subtotal				8,545,992	
ST012-UWBZ21	7.6	162	100	600,753	Submersible installed
ST012-UWBZ22	0.00	146	0	466,988	Pump down, pneumatic plugged
ST012-UWBZ25	1.3	168	168	199,491	
ST012-UWBZ26	Off	133	114	2,408,709	Extraction stopped due to sulfate presence (Sep 2019)
ST012-UWBZ27	Off	128	94	130,011	Extraction stopped due to sulfate presence (May 2019)
ST012-UWBZ30	0.0	172	65	1,397,243	Pump down, pneumatic plugged
UWBZ Subtotal*				6,471,628	
ST012-LSZ09	Off	140	130	2,748,461	Extraction stopped due to sulfate presence (Oct 2019)
ST012-LSZ11	8.2	139	92	3,193,593	
ST012-LSZ12	5.4	130	70	2,477,972	Currently down - electrical issue
ST012-LSZ23	Off	113	94	3,638,934	Extraction stopped due to sulfate presence (Aug 2019)
ST012-LSZ28	NA	162		18,899	Eliminated as an extraction well by FVM#7
ST012-LSZ29	NA	>170		17	Eliminated as an extraction well by FVM#7
ST012-LSZ37	Off	132	90	6,274,757	Extraction stopped due to sulfate presence (Oct 2019)
ST012-LSZ38	Off	160	90	941,898	Extraction stopped due to sulfate presence (Aug 2019)
ST012-LSZ39	Off	92	78	1,250,933	Extraction stopped due to sulfate presence (May 2019)
ST012-LSZ43	3.4	140	135	627,001	
ST012-UWBZ28/LSZ51	NA	146	128	2,536,868	Extraction stopped (Aug 2019), changed to injection end of subphase 2
LSZ Subtotal*				22,440,900	
Total of Wells	36.0			37,458,519	
Treatment System	37.0			29,565,976	

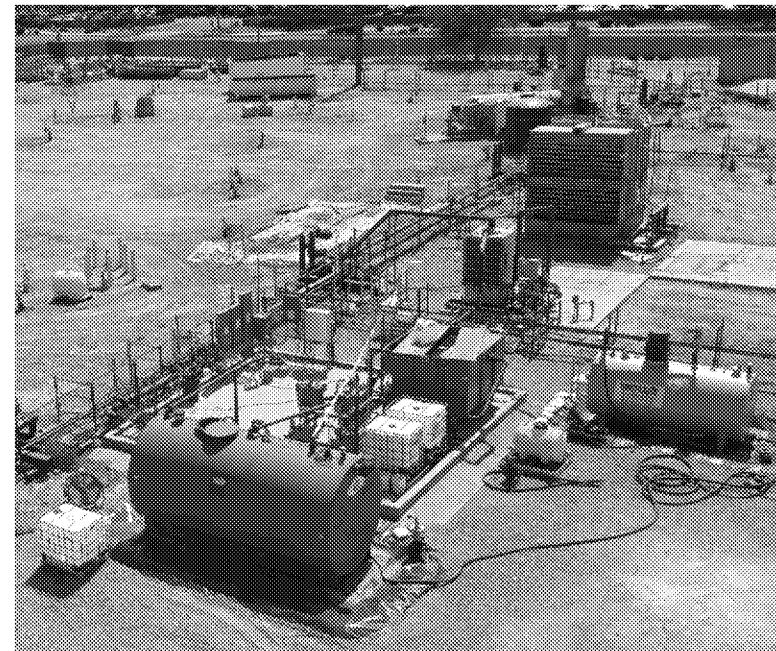
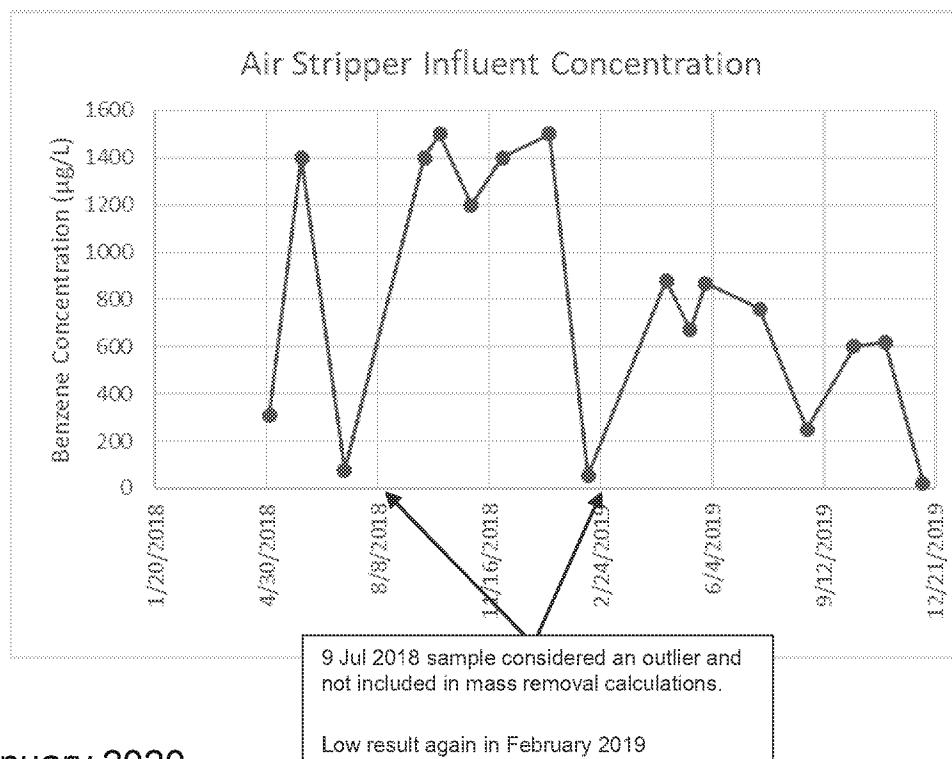
Data is preliminary

* Includes 1/2 of ST012-UWBZ28/LSZ51



Site ST012 Extraction System Performance

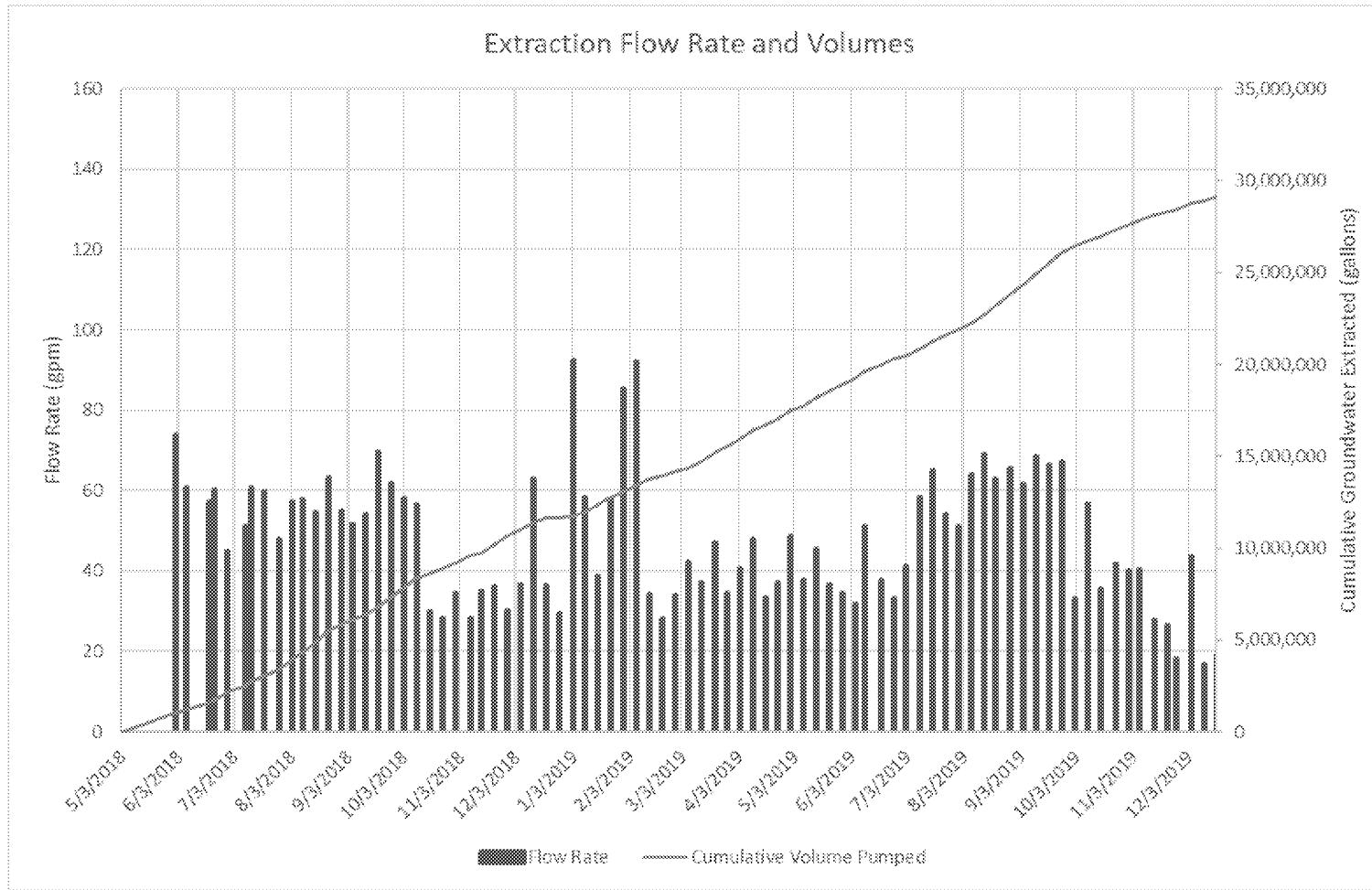
- No LNAPL has been recovered since extraction started up
- Extraction pumps CZ21, UWBZ22, UWBZ30, and LSZ12 currently down
- CZ18, UWBZ26, UWBZ27, LSZ09, LSZ23, LSZ37, LSZ38, and LSZ39 turned off due to sulfate presence
- Benzene air stripper influent at 23 µg/L for December sample





Site ST012 Extraction System Performance

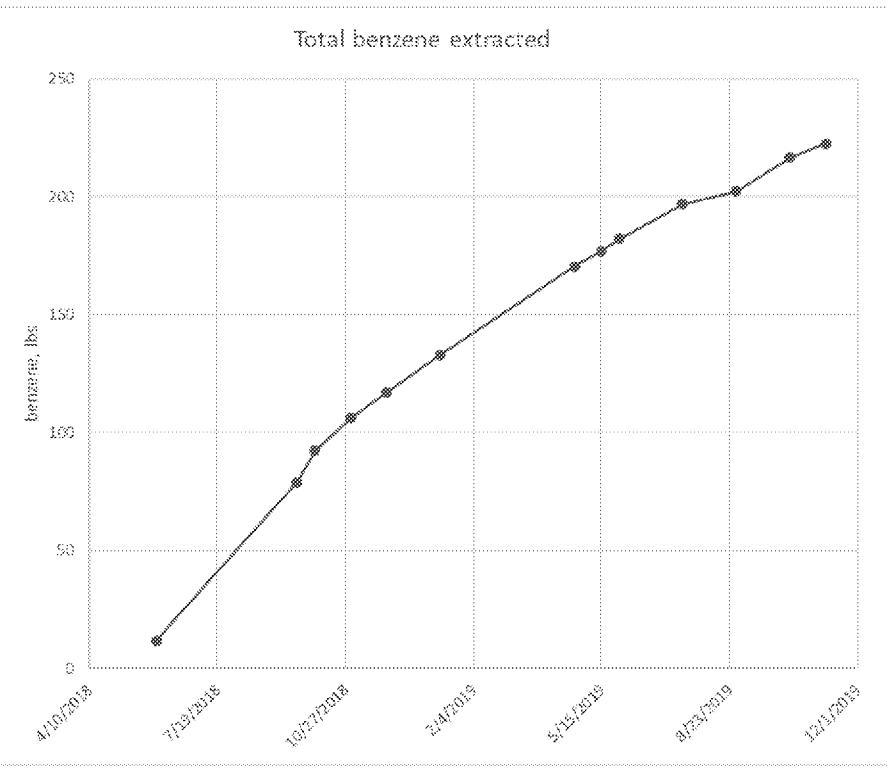
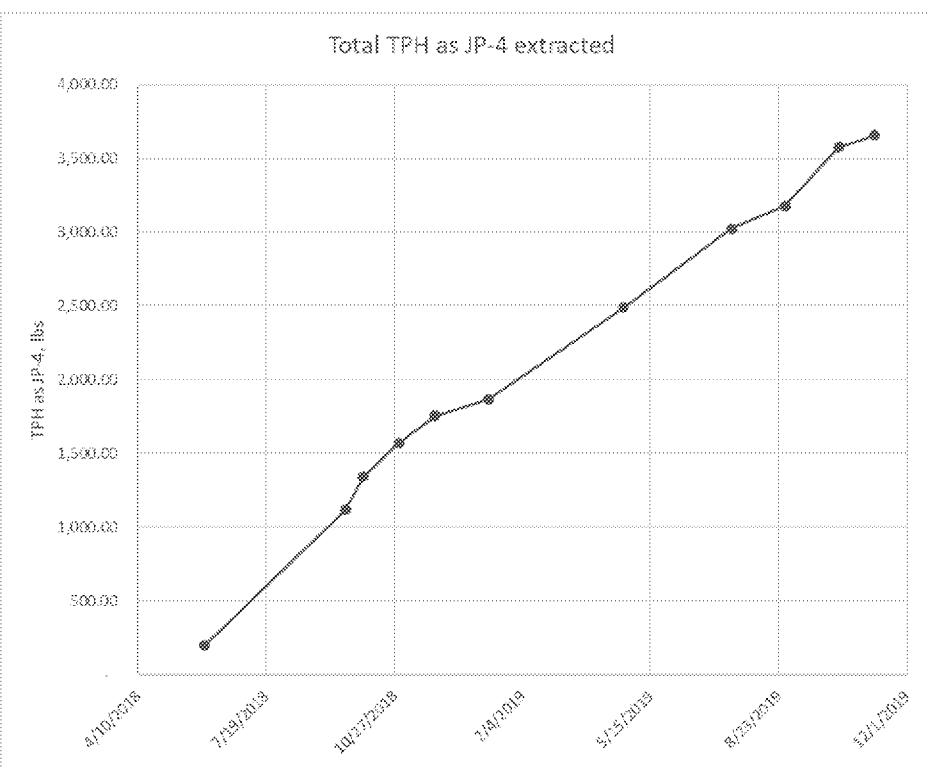
- Overall Extraction Rates and Cumulative Volume Extracted





Site ST012 Extraction System Performance

- Estimated Mass Removal by Extraction
- Not updated since Dec call (12 Dec result had low benzene concentration and TPH analysis is still pending)





Site ST012 Injection Progress

- Injections continued in December
- ~463 tons injected through 19 Dec 2019
- 34 tons injected since last update
- Subphase 4 injections initiated

12/2/2019	4,000	2	113	76	LSZ48 (1.6 tons)
12/3/2019	4,000	2	113	76	LSZ48 (1.6 tons)
12/6/2019	8,000	4	113	76	LSZ48 (0.2 tons), CZ22 (1.4 tons) and UWBZ23 (1.6 tons)
12/9/2019	8,000	4	113	76	LSZ48 (0.2 tons), CZ22 (0.9 tons) and UWBZ23 (2.8 tons)
12/10/2019	6,000	3	113	76	LSZ48 (0.2 tons), CZ22 (0.6 tons) and UWBZ23 (1.5 tons)
12/11/2019	6,000	3	113	76	LSZ48 (0.2 tons), UWBZ23 (1.5 tons) and LSZ50 (1.0 tons)
12/12/2019	6,000	3	113	76	UWBZ23 (1.3 tons) and LSZ50 (1.2 tons)
12/13/2019	6,000	3	113	76	UWBZ23 (1.3 tons) and LSZ50 (1.1 tons)
12/16/2019	6,000	3	113	76	UWBZ23 (2.2 tons) and LSZ50 (0.7 tons)
12/18/2019	6,000	3	113	76	LSZ50 (1.4 tons)
12/19/2018	6,000	3	113	76	LSZ50 (1.1 tons) and LSZ48 (1.4 tons)



Site ST012 Sulfate Field Screening

Date	Sulfate Concentration (mg/L)																								
	CZ02	CZ18	CZ207	CZ20	CZ21	UWBZ15	UWBZ21	UWSZ22	UWBZ24	UWBZ26	UWBZ27	UWBZ28/LSZ31	UWBZ30	LSZ09	LSZ10	LSZ11	LSZ12	LSZ23	LSZ35	LSZ37	LSZ38	LSZ39	LSZ40	LSZ43	LSZ47
4/8/2019	---	---	---	---	---	---	---	---	81	297	---	---	---	---	---	---	---	---	---	---	153	---	---	---	
4/16/2019	---	---	---	---	---	---	---	---	150	520	---	---	---	---	---	---	---	---	---	210	---	---	---	---	
4/23/2019	---	---	---	---	---	---	---	---	1140	6	---	---	---	---	---	---	---	---	---	20	1220	---	---	---	
4/26/2019	---	---	---	---	---	---	---	---	570	18	---	---	---	---	---	---	---	---	---	70	1230	---	---	---	
5/1/2019	---	---	---	---	---	---	---	---	1110	12	---	---	---	---	---	---	---	---	77	1180	---	---	630		
5/8/2019	---	---	---	26	---	---	---	---	720	---	---	---	---	---	---	---	---	---	---	1440	---	---	---	---	
5/13/2019	1	---	11	0	---	4	7	---	1	17	---	1	10	20	90	4	21	---	59	---	12	---	---	---	
5/15/2019	---	---	---	---	---	---	---	---	1190	---	---	---	---	---	---	---	---	---	---	---	1425	---	---	---	
5/22/2019	---	---	---	---	---	---	---	---	1450	0	---	---	---	160	---	---	---	170	---	1420	---	---	---	---	
5/29/2019	10	---	60	0	230	10	30	---	10	270	2000	20	110	2000	1010	90	30	610	0	200	130	1430	---	---	
6/5/2019	---	---	80	---	280	180	---	0	---	160	1240	---	180	320	930	100	---	630	0	290	100	---	0	---	
6/11/2019	0	---	0	230	---	30	---	0	280	---	0	120	320	830	---	0	740	---	410	150	1410	---	---	---	
6/18/2019	---	---	110	---	250	10	---	20	---	280	1080	---	120	570	1020	250	---	670	10	400	240	---	---	---	
6/25/2019	100	---	80	240	---	610	---	0	370	---	0	110	450	860	---	10	630	---	200	90	720	---	---	---	
7/2/2019	---	140	---	180	50	---	270	---	650	1270	---	150	470	920	230	---	540	40	370	130	---	---	0	---	
7/9/2019	100	---	510	600	---	540	---	0	640	---	10	150	450	870	---	200	750	---	420	350	1220	---	---	---	
7/16/2019	---	10	---	250	0	---	0	---	640	290	---	100	220	820	280	---	630	10	430	430	---	---	0	---	
7/23/2019	90	1000	---	430	210	---	480	---	0	630	---	10	270	200	790	---	200	590	---	390	410	1150	---	---	
7/30/2019	---	10	---	230	60	---	0	---	630	900	---	240	310	740	170	---	600	40	400	400	---	0	---	---	
8/6/2019	90	480	---	450	270	---	500	---	0	800	---	250	660	780	---	200	760	---	290	530	1200	---	---	---	
8/13/2019	---	0	---	200	40	---	0	---	580	1000	---	110	300	700	200	---	780	---	300	560	---	---	0	---	
8/20/2019	70	600	---	450	240	---	470	---	0	540	---	100	650	800	---	190	740	---	250	610	---	---	---	---	
8/27/2019	---	off	---	230	10	---	10	---	1370	900	---	130	560	720	340	---	690	---	290	750	---	---	0	---	
9/3/2019	0	280	---	0	210	---	60	---	0	710	---	110	560	670	---	210	870	---	200	1000	---	---	---	---	
9/10/2019	---	200	13	---	60	---	810	580	---	110	590	630	300	---	650	---	210	980	---	---	0	---	---	---	
9/17/2019	10	1030	---	0	250	---	1800	---	0	470	---	100	510	590	---	280	680	---	360	970	---	---	---	---	
9/24/2019	---	100	---	240	12	---	10	---	880	540	---	100	660	590	510	---	700	---	350	870	---	20	0	---	
10/1/2019	0	760	---	0	220	---	1700	---	0	830	---	90	670	600	---	300	550	---	300	750	---	20	0	---	
10/8/2019	---	40	---	260	30	---	0	---	820	600	---	80	710	570	400	---	720	---	340	1500	---	---	0	---	
11/10/2019	120	650	3000	380	--	100	20	0	700	600	480	--	790	470	120	2000	720	2000	400	2000	900	230	0	300	
11/26/2019	140	30	--	10	--	Off	--	450	500	--	--	650	350	--	600	off	--	530	460	--	90	--	100	0	---
12/3/2019	--	100	--	130	--	10	--	---	350	--	--	320	370	360	--	130	--	60	1060	--	200	--	0	-	---
12/10/2019	120	140	--	110	--	40	--	100	--	---	--	700	350	--	470	--	--	100	800	460	570	--	---	---	---
12/17/2020	--	100	140	--	140	--	40	--	---	300	--	--	310	370	200	--	--	120	750	--	550	--	130	0	---

 Screening location is an extraction location
 Screening location is a monitoring well

CZ18, UWBZ26, UWBZ27, LSZ09, LSZ23, LSZ37, LSZ38 and LSZ39 extraction shut down due to sulfate presence.
 Suspect field screening results in October and November not included
 Sulfate concentrations in several wells decreasing



Site ST012 Path Forward Nov-Dec

- Repair SVE Blower VFD and continue SVE rebound measurements
- Continue pump repairs
- Pilot Study Implementation
 - Resample to confirm benzene at U02 on a monthly basis.
 - Deploy BioTraps® at one or more locations based on discussion today (UWBZ26, UWBZ27, LSZ38, LSZ39, W37)



Site ST012 Path Forward Nov-Dec

- Pilot Study Implementation
 - Continue mixing sulfate batches and inject with the following modifications to subphase 4 injection locations
 - Cobble Zone
 - CZ22 – Delay/discontinue injections at this time due to low benzene in area, watch Q1 results in CZ18
 - SVE04D – Move remaining injections (6 tons) to CZ10
 - UWBZ
 - UWBZ10&UWBZ28 – Move injections to UWBZ17 to accelerate distribution to UWBZ25
 - UWBZ23&UWBZ29 – Reduce injection mass based on limited sustained extraction CZ21 and UWBZ30
 - UWBZ33 – Move/focus injections in UWBZ34/35/36 due to better sulfate distribution control
 - LSZ
 - LSZ11 & LSZ43 – Keep pumping to aid distribution rather than change to injection
 - LSZ46 – Eliminate injection at this time due to low benzene concentrations
 - W36 – Pump installed and benzene concentrations currently low, eliminate injection at this time

Air Force Civil Engineer Center



**2020 BCT
MEETINGS/CONFERENCE
CALLS SCHEDULE
DELIVERABLE TRACKING**

**BCT Conference Call
16 January 2020**

Air Force Civil Engineer Center



BCT GENERAL UPDATE AND ACTION ITEMS

BCT Conference Call
16 January 2020